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PATENT ABSTRACTS OF JAPAN

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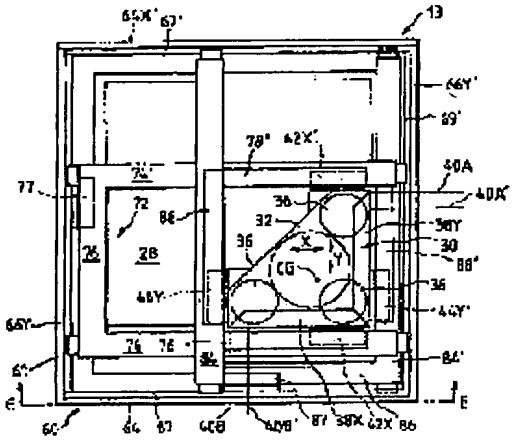
(54) POSITIONING DEVICE, ALIGNMENT DEVICE AND POSITIONING METHOD

(57) Abstract:
PURPOSE: To support an object and control the positioning so that the reaction force and the vibration caused by the motion of the object do not propagate to such an element as lens system.
CONSTITUTION: A reaction frame 61 insulating the external vibration and that caused by the reaction force from an object stage 30 is provided. The object stage 30 moves in two directions. The reaction frame is provided by two followers. Cooperating direct drive force actuators are provided on the object stage and the followers and the object stage is positioned in the first and the second directions. The reaction frame is fixed to a base structure and the object stage is supported in the space independently of the reaction frame. The follower 72 has a pair of arms 74, 74' and moves in a pair of parallel planes wherein the center of gravity of the object stage. The positioning force of actuator driving means is controlled so that the vector sum of the moments of forces at the gravity center of the object stage becomes practically zero.



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[Detailed description]

[0001]

[Field of the Invention] Generally especially this invention relates a wafer to the technique and equipment support and for carrying out alignment and insulating the equipment from the reaction force of itself, and external vibration in microphone ****** graph equipment about electromechanical collimation matching, i.e., alignment, and vibration isolation.

[0002]

[Prior art] The various support devices used for a microphone ****** graph device and the positioning device are known. In the conventional technique, generally, XY guide equipped with separate X guide assembly and Y guide assembly is used, and one guide assembly is attached possible [movement] on the guide assembly of another side. A separate wafer stage is established in the crowning of the above-mentioned guide assembly in many cases. Such structure needs the parts of a high precision and many. Generally, the external force applied to the parts of a positioning assembly and the reaction force resulting from movement of the parts of the others of the above-mentioned positioning assembly are directly transmitted to the device which processes image formation optical system and a reticle (reticle), and, as a result, produce vibration which is not desirable.

[0003] The U.S. patent 5th and No. 120 or 03 (Van Engelen et al.) are indicating the pointing device of the 2 phase formula for optical ********** equipment, and a Lorentz force and static pressure gas bearing are used for this pointing device.

[0004] the U.S. patent of No. 4,952,858 -- electromagnetism -- the thing about the micro lithograph equipment using alignment equipment -- it is -- the above -- electromagnetism -- alignment equipment is equipped with a monolithic stage, a substage, and the criteria structure by which vibration isolation was carried out, and has supported and positioned the above-mentioned monolithic stage on space using the force actuator formed between the above-mentioned monolithic stage and a substage In this equipment, Y frames, i.e., Y stage, are attached in an X frame, and from Y frames, the above-mentioned monolithic stage places space and is supported [above-mentioned].

[0005]

[Object of the Invention] The overall purpose of this invention is offering the technique and equipment using the guide loess stage for supporting the above-mentioned object while it is equipped with the reaction frame insulated from other elements like the lens system which generates the image exposed by the photoresist on the object front face of a wafer in both the external force produced in case an object exercises, and reaction force.

[0006]

[The means for solving a technical problem] It is prepared in a means, and the object stage and reaction frame for the above-mentioned reaction frame supporting independently to space the reaction frame which vibration is not substantially delivered between itself and an object stage, and the above-mentioned object, while the equipment of this invention is attached in an object stage and the base, and it becomes and collaborates in the couple for positioning an object stage, and has a **** type actuator means to generate the force. An object stage is in the status supported by space in the Z direction, and can constitute the X-Y stage which can prepare so that it may exercise in the predetermined orientation, or exercises in the orientation of X, and the orientation of Y.

[0007] The effective characteristic feature of this invention is offering support, a positioning, and the assembly that carries out vibration isolation, this assembly enables the positioning function to in_which the stage of an object or a wafer should be performed, lessens quick extremely vibration transmitted to the above-mentioned stage and a lens system with few parts from the stage which received reaction at that time, and it insulates the above-mentioned stage from the reaction force which is not desirable while it minimizes simultaneously vibration transmitted to the above-mentioned stage.

[0008] According to another characteristic feature of this invention, the positioning technique for X-Y stages and a pointing device are offered, and the above-mentioned X-Y stage is equipped independently with X follower which can exercise, and the **** type force actuator which prepares and collaborates independently between Y follower which can exercise and the above-mentioned X-Y stage, and each follower, and, thereby, is made as [interfere / neither of the movements of the followers / in movement of the follower of another side].

[0009] According to another characteristic feature of this invention, the arm of a couple is prepared in at least one follower, and as for each arm, it has mechanical-component material, and the above-mentioned arm is located in the upper part of the center of gravity of an object stage, and the flat surface ****ed caudad, and can exercise in this flat surface.

[0010] According to another characteristic feature of this invention, the above-mentioned guide loess stage is equipped with at least three **** type force actuators, two of these actuators are driven in either the orientation of X, or the orientation of Y, and the 3rd actuator is driven on another side of the orientation of X, and the orientation of Y. According to the desirable example of this invention, a guide loess stage

Between an X-Y stage and a reaction frame assembly, it has at least four **** type actuators. each actuator It has the mechanical-component material prepared in an X-Y stage, and this plays the role to which X mechanical-component material of a couple drives and carries out automatic control of the X-Y stage in the orientation of X, and the role to which Y mechanical-component material of a couple drives and carries out automatic control of the X-Y stage in the orientation of Y is played. It is constituted, and it is positioned and **** type actuators and these mechanical-component material are controlled so that the vector sum of moment of force in the center of gravity of an X-Y stage resulting from the position force of the mechanical-component material which collaborates becomes equal to a zero substantially.

[0011] The characteristic feature and effect of this invention will become clearer by reading the following explanations with reference to the drawing which the same reference mark shows the same fraction through the whole.

[0012]

[Example] it has a vibration-isolation reaction frame -- it is -- it is -- although having much intended use over the device of the type with which it is [for / many of / the guide loess stage which it does not have positioning an object correctly] different will be understood by this contractor, this invention explains about the desirable example of the gestalt of the microphone ****** graph equipment for carrying out alignment of the wafer in the equipment with which a lens forms the image exposed by the photoresist on the front face of a wafer moreover, it has a vibration isolation stage -- it is -- it is -- although the guide loess stage which it does not have can be used as a guide loess object stage of for example, the orientation of X, or the orientation of Y which can exercise only for ** on the other hand, the desirable example of this invention is explained about XY wafer stage of the guide loess explained below

[0013] Reference of a drawing especially drawing 1 , or drawing 5 shows the ******** graph equipment 10 equipped with the upper optical equipment 12 and the downward wafer support pointing device 13. The optical equipment 12 is equipped with the illuminator 14 equipped with the lamp LMP like a mercury lamp, and ellipsoid mirror EM which surrounds this lamp LMP. The illuminator 14 is equipped with the optical integrator for generating the secondary light source image like the scale-division type lens FEL of a fly, and condenser lens CL for irradiating reticle (mask) R by the equalized flux of light. The mask electrode holder RST holding mask R is attached in the upper part of lens-barrel PL of the projection-optics equipment 16. Lens-barrel PL is being fixed to a part of cylinder assembly currently supported on the high arm 18 of two or more rigidity respectively attached in the crowning of the insulating pad 20, i.e., a blocking device.

[0014] The inertia block 22, i.e., an oscillating absorption block, is formed in equipment so that it may cling to an arm 18. In order to avoid conveying the structure with a weight, after conveying the above-mentioned block 22 by sky condition, it can take the gestalt of the cast box which can fill up sand with an operation site. The base 28 of an object stage, i.e., a wafer stage, is supported from the arm 18 with the block 22 which carries out a sag, the bar 26 which carries out a sag, and the level bar 27 (refer to drawing 2).

[0015] If drawing 5 or drawing 7 is referred to, the plan and elevation of a wafer support pointing device on the base 28 of an object stage, i.e., a wafer stage, are shown, respectively, and the above-mentioned wafer support pointing device is equipped with object (wafer) X-Y stage 30 and the reaction frame assembly 60. X-Y stage 30 is equipped with the support plate 32, and the wafer 34 like a 12 inch (304.8mm) wafer is supported on this support plate. The plate 32 is supported by the vacuum pre-load type pneumatic bearing 36 controllable to adjust an inclination, a sideslip, and a focus in the upper space of the base 28 of an object stage so that Z may be adjusted. Or in order to perform, this support, i.e., support, the combination of a magnet and a coil is also employable.

[0016] X-Y stage 30 is again equipped also with the proper element which consists of the magnetic joint means like a **** type drive motor, and this element carries out alignment of the wafer to the lens of the optical equipment 16, and positions correctly the image for exposing the photoresist of the front face of a wafer. illustration -- an example -- setting -- being magnetic -- combination -- a means -- an X-Y stage -- 30 -- X -- orientation -- setting -- positioning -- a sake -- X -- a drive coil -- 42 -- X -- 42 -- X -- ' -- like -- a couple -- X -- a mechanical component -- material -- an X-Y stage -- 30 -- Y -- orientation -- setting -- positioning -- a sake -- a drive coil -- 44 -- Y -- 44 -- Y -- ' -- like -- a couple -- Y -- a mechanical component -- material -- **** The fraction to which the magnetic joint means on the reaction frame assembly 60 relates is explained in detail later.

[0017] X-Y stage 30 is equipped with the laser mirrors 38X and 38Y of a couple. the above-mentioned laser mirror 38X It operates to laser beam 40A/40A' of the couple of the laser beam interferometer equipment 92. moreover, the above-mentioned laser mirror 38Y It operates to laser beam 40B/40B' of the couple of the above-mentioned interferometer equipment, and exact XY position of the above-mentioned X-Y stage is determined and controlled to the fixed mirror RMX in the lower part section of lens-barrel PL of the projection-optics equipment 16.

[0018] If drawing 8 and drawing 9 are referred to, the reaction frame assembly 60 is equipped with the

reaction frame 61 which has two or more support posts 62, and the above-mentioned support post is attached in the ground or the separate base so that vibration may not be substantially transmitted between this support post and an object stage.

[0019] reaction -- a frame -- 61 -- a support -- a post -- 62 -- between -- X -- orientation -- elongating -- a field -- a plate -- 64 -- X -- 64 -- X -- ' -- a support -- a post -- between -- Y -- orientation -- elongating -- a field -- a plate -- 66 -- Y -- 66 -- Y -- ' -- having -- **** . a field -- a plate -- 64 - 66 -- the inside -- **** -- a plurality -- reaction -- a frame -- a rail -- 67 - 69 -- and -- 67 -- ' - 69 -- ' -- preparing -- having -- X -- a follower -- 72 -- and -- Y -- a follower -- 82 -- supporting -- showing around -- **** . Inside field plate 64X, the upper follower guide rail 67 and the downward follower guide rail 68 (not shown) are formed, and follower guide-rail 67' of the upper part and a lower part and 68' are prepared in the medial surface of field plate 64X' of an opposite side. The single guide rail 69 perpendicularly arranged among guide rails 67 and 68 and 69' are prepared in the medial surface of each field plate 66Y and 66Y', respectively.

[0020] X follower is equipped with the arm 74 of the ****ed couple, and 74', and the end section of these arms is being fixed to the crosspiece 76. The drive truck 78 and the drive element like 78' (refer to drawing 5) are prepared in an arm 74 and 74', respectively, and are made as [collaborate / with drive element 42X of an X-Y stage, and 42X']. In the example of illustration, since drive element 42X on an X-Y stage and 42X' are shown as a drive coil, the drive truck on the X follower 72 has taken the magnetic gestalt. Moreover, a joint element can be reversed, a coil can be prepared on X follower, and a magnet can also be formed on an X-Y stage. In case an X-Y stage drives in X and the orientation of Y, the laser interferometer equipment 92 detects the new position of an X-Y stage at an instant, and generates a positional information (value of an X coordinate). X-Y stage 30 is followed, without the servo type positional-controller equipment 94 controlled by the host processor (CPU) 96 controlling the position of the X follower 72 and the Y follower 82, and carrying out mechanical combination of between drive coil 42X and 42X', and trucks 74 and 74' according to the positional information from the interferometer equipment 92, so that it may explain in detail later with reference to drawing 10 .

[0021] X -- a follower -- 72 -- reaction -- a frame -- 61 -- movement -- possible -- attaching -- a sake -- reaction -- a frame -- 61 -- a side -- it is -- an arm -- 74 -- 74 -- ' -- an edge -- a rail -- 69 -- a top -- riding -- showing around -- having -- an arm -- 74 -- 74 -- ' -- an opposite side -- an edge -- a field -- a plate -- 66 -- Y -- ' -- adjoining -- a rail -- 69 -- ' -- riding In order to move the X follower 72, the mechanical-component material 77 is formed on a crosspiece 76, collaborates with the reaction frame guide 69, and moves a follower 72 in the orientation which intersects perpendicularly to the orientation of X of an X-Y stage. Since an exact control and an exact drive are performed by X-Y stage 30, the point to point control of the X follower 72 does not need to prepare strict tolerance and a strict air gap in an X-Y stage degree correctly at about 30 X-Y stage. therefore, a drive 77 can be made into the combination of the combination of the screw shaft which rotates by the motor, and the nut ****ed by the X follower 72 or the coil assembly which forms a linear motor, and a magnet assembly, and the combination of each above can be further combined with a roller guide device

[0022] X -- a follower -- 72 -- the same -- Y -- a follower -- 82 -- the -- an end -- the section -- a crosspiece -- 86 -- fixing -- having had -- a couple -- an arm -- 84 -- 84 -- ' -- having -- **** -- these -- an arm -- Y -- a mechanical component -- material -- 44 -- Y -- 44 -- Y -- ' -- collaborating -- a truck -- 88 -- 88 -- ' -- having -- **** . The arm 84 of the Y follower 82 and 84' are guided on a separate guide rail. On the upper rail 67 and 67', the both ends of an arm 84 ride, and are shown, and the both ends of arm 84' are shown on the downward rail 68 and 68'. A drive 87 is formed in the crosspiece 86 of the Y follower 82, and moves the Y follower 82 in the orientation which intersects perpendicularly in the orientation of Y of an X-Y stage along with guide 67, 67' and 68, and 68' between field plate 66Y and 66Y'.

[0023] As best shown in drawing 9 , all of the arm 74, 74', and crosspiece 76' of the X follower 72 are arranged in the same flat surface which intersects perpendicularly with Z axis, and they move. The center of gravity of X-Y stage 30 is in the above-mentioned flat surface, or adjoins this flat surface immediately. In this structure, each drive coil 42X and the driving force from 42X' are committed in an arm 74 and the orientation which meets the length of 74', respectively. However, the arm 84 of the Y follower 82 and 84' are mutually ****ed along with Z axis, and each is in the upper part of the flat surface containing the X follower 72, and a separate parallel flat surface parallel [that it is caudad] to this flat surface, and moves in the flat surface. In a desirable example, a crosspiece 86 is in the flat surface of the lower part containing arm 84', and spacer block 86' is located between the edges where the arm 84 and the crosspieces 86 overlap, and it is ****ing an arm 84 and 84' at each parallel flat surface. Each drive coil 44Y and the driving force from 44Y' are committed like the X follower 72 in an arm 84 and the orientation which meets the length of 84'. Moreover, between drive coil 44Y (44Y') and the drive truck 88 (88'), a predetermined gap is maintained by the orientation of X, and the Z direction, and the idea of guide loess is attained.

[0024] In case the guide loess stage of this invention and a vibration isolation type reaction frame operate X-Y stage 30 is positioned by the initial valve position to a projection lens detected by the interferometer equipment 92. X-Y stage 30 a drive -- a truck -- 78 -- 78 -- ' -- 88 -- 88 -- ' -- a configuration -- depending --

a drive -- an element -- **** -- a drive coil -- 42 -- X -- 42 -- X -- ' -- 44 -- Y -- 44 -- Y -- ' -- ****ing -- having had -- the status -- pneumatic bearing -- an object -- a stage -- the base -- 28 -- **** -- a Z direction -- supporting -- having . There is no contact between X-Y stage 30 and the reaction frame 61. That is, vibration of a reaction frame is transmitted and the path which affects the position of an X-Y stage, or its opposite path does not exist at all. The positional information as which the above-mentioned position detection equipment only detected that the means of communication which sends a signal to a coil, and the indirect contact through the position detection equipment of a laser interferometer existed is sent to a controller, i.e., a control unit, and this control unit receives other commands which start the driving signal which produces movement of X-Y stage 30.

[0025] an interferometer -- equipment -- 92 -- **** -- an X-Y stage -- a position -- understanding -- if -- a driving signal -- a positional controller -- equipment -- 94 -- **** -- being suitable -- a drive coil -- 42 -- X -- 42 -- X -- ' -- 44 -- Y -- 44 -- Y -- ' -- sending -- having -- an X-Y stage -- the position of a new request -- driving . Movement of an X-Y stage is detected by the interferometer equipment 92 and the position sensors 98X and 98Y (refer to drawing 10), and the X follower 72 and the Y follower 82 are driven by the mechanical-component material 77 and 87, respectively, and follow an X-Y stage. As shown in drawing 10 , position-sensor 98X detects change of the spacing of the orientation of Y between X-Y stage 30 and the X follower 72, and sends the electrical signal showing the value of the spacing to the positional-controller equipment 94. The positional-controller equipment 94 generates the proper driving signal about the mechanical-component material 77 based on the signal from X position and position-sensor 98X from the interferometer equipment 92.

[0026] Moreover, position-sensor 98Y detects change of the spacing of the orientation of X between X-Y stage 30 and the Y follower 82, and generates the electrical signal showing the value of the spacing, and the mechanical-component material 87 drives it based on the signal from the information and position-sensor 98Y of Y position from the interferometer equipment 92.

[0027] A yaw angle amendment is performed by the motor pair which can use a yaw angle for a maintenance or amendment sake. That is, the above-mentioned motor pair can change the position of the hand of cut of an X-Y stage. The data from both laser beam 40A/40A', and 40B/40B' are used in order to acquire a yaw angle information. [both / one side or] Electronic subtraction of the digital position data obtained from the measurement using laser beam 40A, 40A' or 40B, and 40B' is performed, or both difference is added, and it divides by 2.

[0028] this invention enables it to perform the positioning function of an X-Y stage more quickly than the case where XY guide is used. The reaction force produced in case an X-Y stage moves is separated from image formation optical system and a reticle processor device.

[0029] Since this invention does not need exact X guide or Y guide at all and does not have a precise guide as compared with the stage guided, the precise assembly of the X-Y stage of a wafer and operation of adjustment decrease. Since the force of the linear motor in XY axis does not need to act on the stage of a wafer directly, that is, the above-mentioned linear motor does not need to act through guide equipment, the control bandwidth of a servo increases.

[0030] Altogether, the force from XY linear motor can be made to transmit through the center of gravity of an X-Y stage substantially, and, thereby, eliminates the moment of force (torque) which is not desirable.

[0031] the X follower 72 and the Y follower 82 which it has independently completely mutually and operate -- using -- magnetic distributor shaft coupling between each followers 72 and 82 and X-Y stages 30 ****** -- commercial -- available electromagnetism -- if a linear motor is used and the clearance between a coil and a magnet drive truck is made smaller than about 1mm, no vibration of a follower will be transmitted to the X-Y stage or optical equipment of a wafer Moreover, the vector sum of the upper part of the arm of the follower of another side and moment of force [in / when it ****s caudad / the center of gravity of an X-Y stage] becomes equal to a zero substantially about the arm of one follower according to the positioning force of the mechanical-component material which collaborates.

[0032] Between an X-Y stage and each follower stage, it could be considered that vibration is transmitted with the degree of freedom of X, Y, or theta that the connection to permit does not exist at all among these stages. Thereby, a follower stage can be attached in the vibrating criteria frame, without affecting the performance of the stage of a wafer. For example, an X-Y stage and projection-optics equipment will not be influenced when a reaction frame hits with an obstruction.

[0033] When the center of gravity is between one of two X drive coils, and one of two Y drive coils and there is in the equal distance, the proper signal with which a size is different will be sent to each coil, the bigger force will be given to it at a heavier stage side, and, thereby, driving an X-Y stage to a desired position will be understood by this contractor. [no]

[0034] specialization -- intended use -- receiving -- electromagnetic force -- movement -- being possible -- an X-Y stage -- giving -- a sake -- an actuator -- namely, -- magnetic coupling -- an assembly -- a drive -- an element -- 42 -- X -- /-- 42 -- X -- ' -- or -- 42 -- Y -- /-- 42 -- Y -- ' -- X -- orientation -- or -- Y -- orientation -- it can set -- a stage -- movement -- being related -- respectively -- having stood it still -- the

status -- a fixed position --

[0035] As an explanation of the last of this example, the essential structure of this invention is explained again with reference to drawing 4 . It can exercise in X, Y, and the orientation of theta on the stage base 28, without X-Y stage's 30 being ****ed by the flatness of the stage base 28 by the pneumatic bearing 36 which has an air issue port and a vacuum pre-load port on the smooth front face (it being parallel to an X-Y flat surface), and receiving a friction in any way, as shown in drawing 4 .

[0036] The stage base 28 is ****ed by the vibration isolation block 20, the arm 18, the block 22, the perpendicular bar 26, and the level bar 27 on the footing (or the ground or base structure). Each vibration isolation block 20 is equipped with the oscillating absorption assembly which prevents transmission of the vibration from a footing 21.

[0037] Since drawing 4 is a cross section of X-Y stage 30 which meets the line which passes along drive coil 42X and 42X' in the orientation of Y, the following explanations are limited to the X follower 72. drawing 4 -- setting -- a drive coil -- 42 -- X -- a follower -- an arm -- 74 -- equipping -- having had -- a drive -- a truck (train of a magnet long and slender in the orientation of X) -- 78 -- a magnetic field -- inside -- preparing -- having -- **** -- a drive coil -- 42 -- X -- ' -- a follower -- an arm -- 74 -- ' -- equipping -- having had -- a drive -- a truck -- 78 -- ' -- a magnetic field -- inside -- preparing -- having -- **** --

[0038] Two arms 74 and 74' are strongly assembled by the guide rail 69 and 69' which were formed inside the reaction frame 61 so that it may move in the orientation of Y together. Moreover, a guide rail 69 and 69' restrict X of two arms 74 and 74', and movement of a Z direction. The reaction frame 61 is directly supported independently on the footing 21 in the stage base 28 in four support posts 62.

[0039] Therefore, drive coil 42X (42X') and the drive truck 78 (78') are arranged by each so that a predetermined gap (several millimeters) may be maintained in Y and a Z direction. Therefore, if drive coil 42X and 42X' drives and X-Y stage 30 is moved in the orientation of X, the drive truck 78 and the reaction force produced in 78' will be transmitted to a footing 21, and will not be transmitted to X-Y stage 30.

[0040] On the other hand, when X-Y stage 30 moves in the orientation of Y, two arms 74 and 74' follow each drive truck 78 and 78' by this at each coil 42X and 42X' based on the measurement signal of position-sensor 98X by moving in the orientation of Y by the mechanical-component material 77, and the gap of the orientation of Y is maintained.

[0041] this invention -- a couple -- a mechanical component -- material -- namely, -- a coil -- 42 -- X -- 42 -- X -- ' -- and -- a couple -- a mechanical component -- material -- namely, -- a coil -- 44 -- Y -- 44 -- Y -- ' -- having -- being desirable -- an example -- referring to -- having explained -- although -- drawing 11 -- and -- drawing 12 -- being shown -- **** -- exactly -- three -- a ** -- a mechanical component -- material -- namely, -- a linear motor -- having -- an As shown in drawing 11 , Y drive coil 144Y of a couple and 144Y' are prepared in a stage 130, and it doubles, single X drive coil, i.e., linear motor 142X, and it is prepared in center-of-gravity CG' of an X-Y stage. Y drive coil 144Y and 144Y' is prepared in the arm 184 of the Y follower 182, and 184', and X drive coil 144X is prepared in arm 174" of the X follower 172. An X-Y stage can be moved to desired XY position by giving a proper driving signal to drive coils 142X and 144Y and 144Y'.

[0042] next -- drawing 13 -- or -- drawing 16 -- referring to -- if -- this invention -- being another -- an example -- being shown -- having -- **** -- this -- an example -- XY -- a drive coil -- 242 -- X -- 242 -- X -- ' -- 244 -- Y -- 244 -- Y -- ' -- an X-Y stage -- 30 -- ' -- attachment -- the section -- between -- a link -- having -- **** . These bond parts are equipped with the double flat spring assembly 300 which combines drive coil 244Y with the end section of the bond-part material 320, and the double flat spring assembly 320 which combines the other end of the bond-part material 320 with X-Y stage 30'. The double flat spring assembly 300 has the flange 302 fixed to coil 244Y. Through the clamp bolt, the clamp component 304 is attached in the flange 302, and has faced across one pars marginalis of the level flexible link 306 between them. These level components are fixed to a perpendicular flange 310 and perpendicular one in order by pinching the other end of the flexible link 306 between two level components 308, the bolt setting of the flange material 312 of a couple is carried out to this perpendicular flange, and the flange material of this couple has faced across one pars marginalis of the perpendicular flexible component 314. It faces across the perpendicular pars marginalis of another side of the flexible component 314 between the flange material 316 of a couple, and the bolt setting of the flange material of this couple is carried out to the flange plate 318 of the end section of a holddown member 320 at order. In the other end of a holddown member 320, the plate 348 is being fixed to two flange material 36, and the bolt setting of these two flange material is mutually carried out so that the end section of the perpendicular flexible component 344 may be inserted. the flange material 342 faces across the perpendicular pars marginalis of the opposite side of a component 344, and these flanges material is fixed to the plate 340 fixed to the clamp plate 338 of the couple which faces across one pars marginalis of the level flexible component 336 in order -- having -- **** -- the above -- the level pars marginalis of the opposite side of a flexible component is inserted into X-Y stage 30' in response to the assistance of a plate 334 Therefore, in each double flat spring assemblies 300 and 330, vibration decreases by [level] reaching and preparing both of perpendicular flexible components. in the

assembly of these each, a perpendicular flexible component decreases vibration of X, Y, and theta, and a level flexible component decreases vibration of Z, an inclination, and the sideslip orientation Therefore, eight horizontal deflection joint about the deflection joint and Z, the inclination, and the sideslip orientation of eight perpendicular directions about X, Y, and theta is prepared.

[0043] As shown in drawing 16 , coil 244Y is attached in coil support 245Y, this coil support has the upper support plate 246 attached in this, and this upper support plate has ridden on the crowning of the magnetic-track assembly 288. The vacuum pre-load type pneumatic bearing 290 is again formed between the magnetic-track assemblies 288 as another side with coil support 245Y and the upper support plate 246 as one side. In the example of an operation of the example shown in drawing 13 or drawing 16 , for width of face, about 31.8 mm (1 1 / 4 inches) and a length are [about 6.4mm (1/4 inch) and the thickness of the flexible components 306, 314, 344, and 336] 0.305mm (0.012 inches) stainless steel, and the orientation of a primary deflection is the orientation of thickness. In the example of illustration, components 306 and 314 are in the direct transposition **** status mutually, each orientation of a primary deflection is arranged in series, and components 344 and 336 are arranged similarly.

[0044] Although this invention was explained about the desirable example, this invention can take the gestalt from which many are different, and the domain of this invention is limited by only the claim.

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[An easy explanation of a drawing]
[Drawing 1] It is the perspective diagram of the microphone ****** graph equipment which adopted this invention.
[Drawing 2] The reaction stage which is the perspective diagram of a part of structure shown by line A-A in drawing 1 , and is shown in drawing 1 is omitted.
[Drawing 3] It is the elevation showing a part of structure shown in drawing 1 in a cross section.
[Drawing 4] It is the rough elevation showing a part of object pointing device of this invention in a cross section.
[Drawing 5] It is the plan of the X-Y stage position of the wafer in the reaction stage upper part.
[Drawing 6] the side which shows a part of structure shown in drawing 5 in the orientation of the arrow head along with a line 6-6 -- it is an elevation
[Drawing 7] It is the enlarged view of a part of structure shown by line B-B in drawing 6 .
[Drawing 8] In order to position an X-Y stage, it is the perspective diagram of a reaction stage removing the means fixed to the X-Y stage, and showing XY follower.
[Drawing 9] It is the expansion perspective diagram of XY follower shown in drawing 8 .
[Drawing 10] They are a position detection of the desirable example of this invention, and the rough block diagram of a control unit.
[Drawing 11] It is the same plan as drawing 5 showing another example of this invention.
[Drawing 12] the same side as drawing 6 which shows the example of drawing 11 -- it is an elevation
[Drawing 13] It is the same plan as drawing 5 showing still another example of this invention.
[Drawing 14] the same side as drawing 6 which shows the example of drawing 13 -- it is an elevation
[Drawing 15] It is the expansion plan of a part of structure shown in drawing 13 .
[Drawing 16] It is the end view of the above-mentioned structure shown in the orientation of the arrow head along with the line 16-16 of drawing 15 .
[An explanation of a sign]
10 ******** Graph Equipment
12 Optical Equipment (Optical System)
28 Base of Object Stage
30 X-Y Stage
34 Object (Wafer)
36 Pneumatic Bearing
42X, 42X' X mechanical-component material (X drive coil)
44Y, 44Y' Y mechanical-component material (Y drive coil)
60 Reaction Frame Assembly
61 Reaction Frame
72 X Follower
74, 74' Arm of X follower
82 Y Follower
84, 84' Arm of Y follower

[Translation done.]

[Claim]

[Claim 1] In the pointing device (a) which operates on base structure The reaction frame assembly containing the reaction frame attached in the aforementioned base structure, (b) The object stage which exercises relatively to the base of an object stage, (c) The means for setting a spacing from the base of the aforementioned object stage, and supporting the aforementioned object stage independently with the aforementioned reaction frame (d) It is attached in the aforementioned object stage and the aforementioned reaction frame assembly. Become and collaborate in the couple for positioning the aforementioned object stage, and it has a **** type actuator means to generate the force. The pointing device which the base of the aforementioned object stage and the aforementioned object stage are insulated from the reaction force from the aforementioned actuator means, and is characterized by transmission of the vibration to the base of the aforementioned object stage and the aforementioned object stage serving as the minimum by this.

[Claim 2] The pointing device with which the aforementioned reaction frame assembly is characterized by having the follower which can exercise for the aforementioned object stage independently and can follow it in the pointing device of a claim 1.

[Claim 3] The pointing device characterized by equipping the aforementioned actuator means with at least one linear motor which operates between the aforementioned object stage and the aforementioned reaction frame assembly in the pointing device of a claim 1.

[Claim 4] the pointing device characterized by having the mechanical-component material by which it has the actuator means of a couple at least in the pointing device of a claim 1 in order to position the aforementioned object stage, and the actuator means of these each was attached in the aforementioned object stage

[Claim 5] The pointing device with which the vector sum of moment of force in the center of gravity of the aforementioned object stage resulting from the positioning force of the aforementioned mechanical-component material is characterized by being substantially equal to a zero in the pointing device of a claim 4.

[Claim 6] The pointing device characterized by having at least one mechanical-component material attached in the aforementioned object stage in the pointing device of a claim 2.

[Claim 7] The pointing device characterized by equipping the aforementioned follower with two arms which can exercise, respectively in two parallel flat surfaces, and the center of gravity of the aforementioned object stage being between the two aforementioned flat surfaces in the pointing device of a claim 2.

[Claim 8] In the pointing device of a claim 1 the aforementioned object stage In the 1st orientation, and this 1st orientation and the 2nd orientation which makes an angle, it can exercise at least. The 1st follower is movable only in the 1st aforementioned orientation, and follows the aforementioned object stage. The 2nd follower is movable only in the 2nd aforementioned orientation, follows the aforementioned object stage, and moreover, the aforementioned actuator means which carries out collaboration The pointing device characterized by being prepared in the aforementioned object stage, the above 1st, and the 2nd follower, and positioning the aforementioned object stage in the above 1st and the orientation of the 2nd.

[Claim 9] It is the pointing device characterized by having the **** type actuator which generates at least three force in which the aforementioned actuator means operates between the aforementioned object stage and the aforementioned reaction frame assembly in the pointing device of a claim 8.

[Claim 10] the pointing device of a claim 9 -- setting -- the above -- the pointing device with which it is prepared and the vector sum of moment of force in the center of gravity of the aforementioned object stage resulting from the positioning force of an actuator means to collaborate is characterized by being substantially equal to a zero as the aforementioned object stage driven in the 1st aforementioned orientation in two of three **** type actuators as it is few

[Claim 11] The pointing device with which it is attached in the aforementioned object stage, and the vector sum of moment of force in the center of gravity of the aforementioned object stage resulting from the positioning force of the aforementioned actuator means which carries out collaboration is characterized by being substantially equal to a zero in the pointing device of a claim 10 as the aforementioned object stage driven in one of the aforementioned **** type actuators other than the two aforementioned **** type actuators in the 2nd aforementioned orientation.

[Claim 12] In the pointing device of a claim 8, it has at least 2 sets of **** type actuators for positioning the aforementioned object stage. 1 set in these ****s type actuator 1 set which will position the aforementioned object stage in the 1st aforementioned orientation, and will accept it among the aforementioned **** type actuators The pointing device with which the vector sum of moment of force in the center of gravity of an X-Y stage which positions the aforementioned object stage in the 2nd aforementioned orientation, and originates in the position force of an actuator means to these-collaborate is characterized by being substantially equal to a zero.

[Claim 13] the pointing device of a claim 8 -- setting -- the above 1st and the 2nd follower -- each and two ****ed arms -- having -- **** -- the inside of the flat surface with the single arm of one follower -- being located -- movement -- possible -- moreover, the arm of the follower of another side -- the above -- the

pointing device characterized by locating a single flat surface in two parallel flat surfaces located between them, and being able to exercise

[Claim 14] the pointing device of a claim 13 -- setting -- the center of gravity of the aforementioned object stage -- the above -- the pointing device characterized by being adjacently located in the inside of a single flat surface, or the flat surface of this ** 1

[Claim 15] In a pointing device (a) In the 2nd orientation which makes an angle in the 1st orientation and this 1st orientation Object stage which exercises at least (b), The 1st follower which is movable only in the 1st aforementioned orientation and follows the aforementioned object stage, (c) The 2nd follower which is movable only in the 2nd aforementioned orientation and follows the aforementioned object stage, (d) Pointing device characterized by having a **** type force actuator means to collaborate for being attached in the aforementioned object stage, the above 1st, and the 2nd follower, and positioning the aforementioned object stage in the above 1st and the orientation of the 2nd.

[Claim 16] It is the pointing device characterized by having at least three ******** actuators with which the aforementioned actuator means operates between the aforementioned object stage and each aforementioned follower in the pointing device of a claim 15.

[Claim 17] the pointing device of a claim 16 -- setting -- the above -- the pointing device with which it is prepared and the vector sum of moment of force in the center of gravity of the aforementioned object stage resulting from the positioning force of an actuator means to collaborate is characterized by being substantially equal to a zero as the aforementioned object stage driven in the 1st aforementioned orientation in two of three **** type actuators as it is few

[Claim 18] The pointing device with which it is attached in the aforementioned object stage, and the vector sum of moment of force in the center of gravity of the aforementioned object stage resulting from the positioning force of the aforementioned actuator means which carries out collaboration is characterized by being substantially equal to a zero in the pointing device of a claim 17 as the aforementioned object stage driven in one of the aforementioned **** type actuators other than the two aforementioned **** type actuators in the 2nd aforementioned orientation.

[Claim 19] In the pointing device of a claim 15, it has at least 2 sets of **** type actuators for positioning the aforementioned object stage. 1 set in these ****s type actuator The aforementioned object stage is positioned in the 1st aforementioned orientation. another side of the aforementioned **** type actuators The pointing device with which the vector sum of moment of force in the center of gravity of an object stage which positions the aforementioned object stage in the 2nd aforementioned orientation, and originates in the position force of an actuator means to these-collaborate is characterized by being substantially equal to a zero.

[Claim 20] the pointing device of a claim 15 -- setting -- the above 1st and the 2nd follower -- each and two ****ed arms -- having -- **** -- the inside of the flat surface with the single arm of one follower -- being located -- movement -- possible -- moreover, the arm of the follower of another side -- the above -- the pointing device characterized by locating a single flat surface in two parallel flat surfaces located between them, and being able to exercise

[Claim 21] the pointing device with which the vector sum of moment of force in the center of gravity of the aforementioned object stage which the follower of each above has at least one mechanical-component material, and originates in the positioning force of the mechanical-component material which collaborates in the pointing device of a claim 20 is characterized by being substantially equal to a zero

[Claim 22] the pointing device of a claim 20 -- setting -- the center of gravity of the aforementioned object stage -- the above -- the pointing device characterized by being adjacently located in the inside of a single flat surface, or the flat surface of this ** 1

[Claim 23] The reaction frame assembly which has the reaction frame prepared in the base and base structure of an object stage in the pointing device of a claim 15, The means for supporting each aforementioned follower from the aforementioned reaction frame assembly, With the aforementioned reaction frame, the base of the aforementioned object stage to a spacing is set for the aforementioned object stage, and it has a means for supporting independently. by this The pointing device characterized by being constituted so that the base of the aforementioned object stage and the aforementioned object stage may be insulated from vibration produced with each reaction force, therefore vibration of the base of the aforementioned object stage and the aforementioned object stage may become the minimum.

[Claim 24] In alignment equipment (a) The X-Y stage which has the center of gravity, (b) The means for setting the aforementioned X-Y stage from the base of an X-Y stage, and supporting a spacing, (c) It has the reaction frame assembly which has the reaction frame which became independent with the base of the aforementioned X-Y stage, and which was supported on the base of a reaction frame. (d) The aforementioned reaction frame assembly And it has independently Y follower which can exercise. becoming independent -- X follower which can exercise -- an installation ******s X follower possible [movement] on the aforementioned reaction frame an installation ******s Y follower possible [movement on the aforementioned reaction frame] that it can exercise in the orientation of X It can exercise in the orientation of Y (e). Either the aforementioned X follower or Y follower It has at least two ****ed arms.

another side of the aforementioned X follower and Y follower It has at least one arm. the concerned alignment equipment further (f) It is prepared by the relation ****ed between the aforementioned X-Y stage and each aforementioned follower. It has a **** type actuator means for the couple for positioning the aforementioned X-Y stage horizontally to collaborate, and to generate the force (g). The aforementioned actuator means It is prepared in the aforementioned X-Y stage to the mechanical-component part element means prepared in the arm of the follower of each above, and it. It has a drive primary-member means to collaborate with the aforementioned mechanical-component part element means, and to position the aforementioned X-Y stage. the base of the aforementioned X-Y stage and the aforementioned X-Y stage Alignment equipment which is insulated from vibration produced with reaction force, and is characterized by being constituted so that vibration of the base of the aforementioned X-Y stage and the aforementioned X-Y stage may become the minimum by this.

[Claim 25] In the alignment equipment of a claim 24, the one aforementioned arm prepared in either the aforementioned X follower or the Y followers Two arms which are arms of the aforementioned couple which can exercise in a single flat surface and was prepared in another side of the aforementioned X follower and Y follower the meantime -- the above -- the alignment equipment characterized by locating in two independent flat surfaces in which a single flat surface is located, respectively, and being able to exercise in this flat surface

[Claim 26] Alignment equipment whose vector sum of moment of force in the center of gravity of the aforementioned X-Y stage which has the aforementioned mechanical-component part element means prepared in the arm of the aforementioned couple of the one aforementioned follower in the alignment equipment of a claim 25, is equipped with the means for controlling it, and originates in the positioning force of a drive primary-member means to collaborate is characterized by being substantially equal to a zero.

[Claim 27] In the technique (a) for positioning an object The process which positions a reaction frame on the base, (b) Process which supports an object on an object stage (c), About the aforementioned object, the aforementioned reaction frame becomes independent. The process which supports the aforementioned object stage on space in a certain position from the base of an object stage, (d) Apply the force between the aforementioned object stage and the aforementioned reaction frame, and the aforementioned object stage is driven in the new position of at least one orientation of [on space]. The positioning technique characterized by having the process which insulates the base of the aforementioned object stage from the reaction force simultaneously produced by applying the aforementioned force.

[Claim 28] By the 1st follower and the 2nd follower, by moving in the 1st orientation and the orientation of the 2nd at least In the technique (a) of positioning an object stage to space The process which supports the aforementioned object stage to space, (b) The force between the aforementioned object stage and the 1st aforementioned follower In addition, the process which drives the aforementioned object stage only in the 1st aforementioned orientation, (c) The force between the aforementioned object stage and the 2nd aforementioned follower In addition, the process which drives the aforementioned object stage only in the 2nd aforementioned orientation, (d) Only in the 2nd aforementioned orientation, it becomes independent with the 2nd aforementioned follower. The process which drives the 1st aforementioned follower and is made to follow the aforementioned object stage, (e) The positioning technique of the object characterized by driving the 2nd aforementioned follower and having independently the process made to follow the aforementioned object stage with the first aforementioned follower only in the 1st aforementioned orientation.

[Claim 29] The pointing device with which it has a means to attach the aforementioned actuator means between the aforementioned object stage and the aforementioned reaction frame, in the pointing device of a claim 1, and this installation is characterized by the strong thing in the driving force orientation at least.

[Claim 30] The pointing device with which it has a means to attach the aforementioned actuator means between the aforementioned object stage and each aforementioned follower, in the pointing device of a claim 15, and this installation is characterized by the strong thing in the aforementioned driving force orientation at least.

[Claim 31] The pointing device with which it has in the pointing device of a claim 24 with a means to attach the aforementioned actuator means between the aforementioned X-Y stage and each aforementioned follower, and this installation is characterized by the strong thing in the aforementioned driving force orientation at least.

[Claim 32] In the precision pointing device made as [collaborate / although it has the stage which can exercise along predetermined orientation in a flat surface top] the base plate which has a flat surface -- this -- (a) The 1st support assembly for supporting the aforementioned base plate on a footing, (b) It has an actuator assembly for giving electromagnetic force to the stage in which the aforementioned movement is possible along the aforementioned predetermined orientation. This actuator assembly is (i). ****-ed which is attached in the stage in which the aforementioned movement is possible, and can exercise in the aforementioned predetermined orientation and which can be exercised, And (ii) The mechanical component located in the periphery of the stage in which the aforementioned movement is possible is provided. (iii)

Either the aforementioned ****-ed or the aforementioned mechanical component has a coil unit. Moreover, it has the magnetic unit and another side of the aforementioned ****-ed and the aforementioned mechanical component is (c) further. The aforementioned mechanical component is supported independently on the aforementioned footing with the support assembly of the above 1st. by this The precision pointing device characterized by having the 2nd support assembly which forms a predetermined gap between the aforementioned coil unit and the aforementioned magnetic unit.

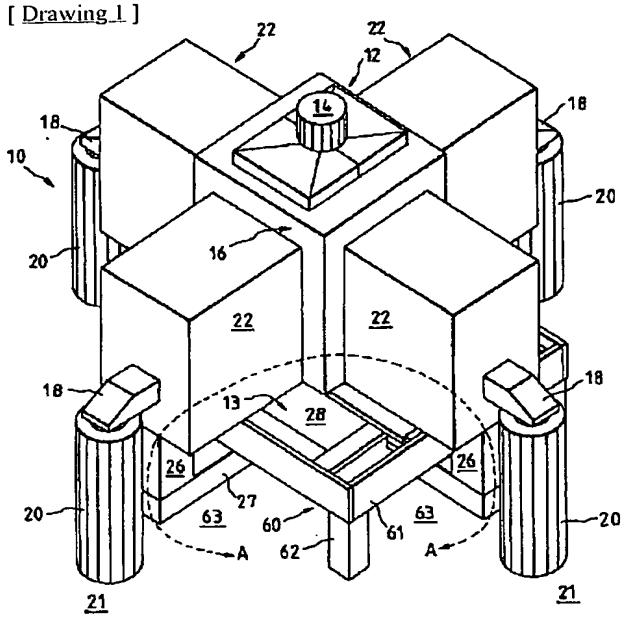
[Claim 33] The precision pointing device characterized by being held in the precision pointing device of a claim 32 in the position where the aforementioned mechanical component of the aforementioned actuator assembly stood it still to the aforementioned predetermined orientation.

* NOTICES *

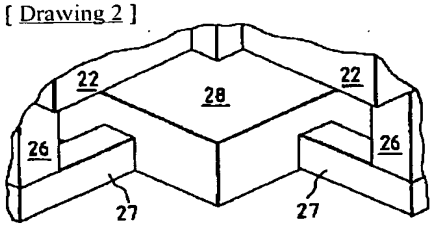
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



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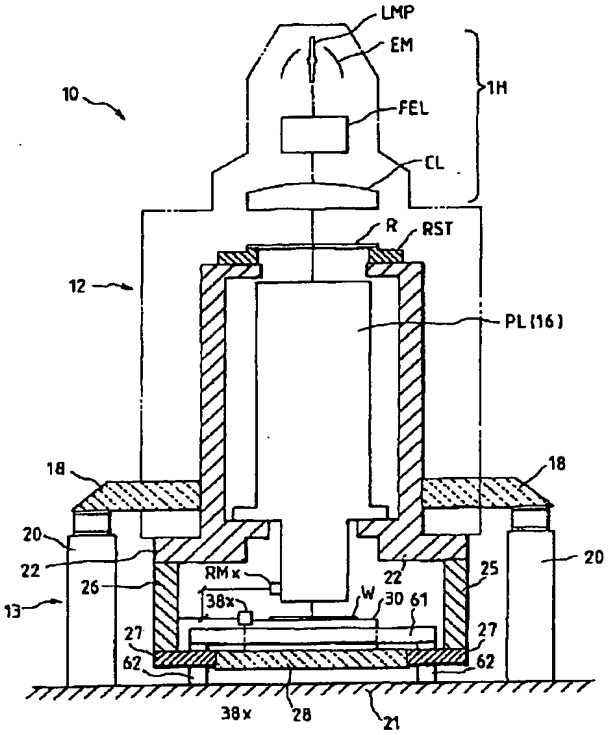

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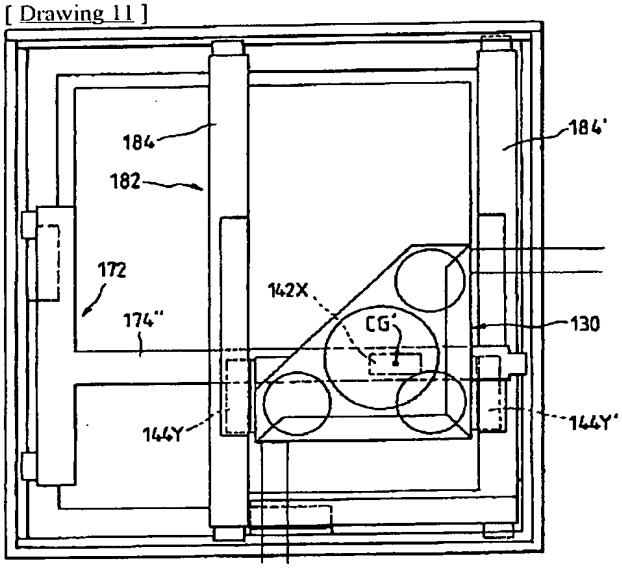

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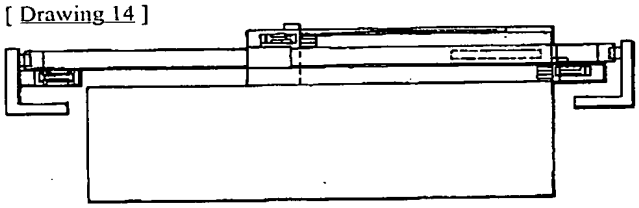

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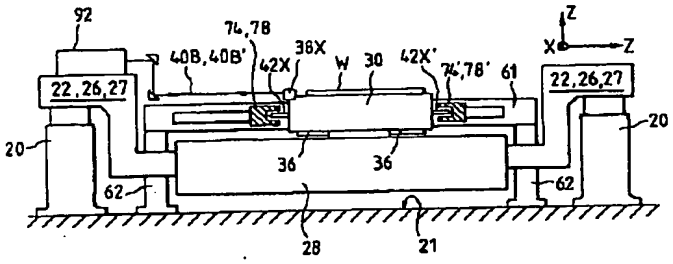

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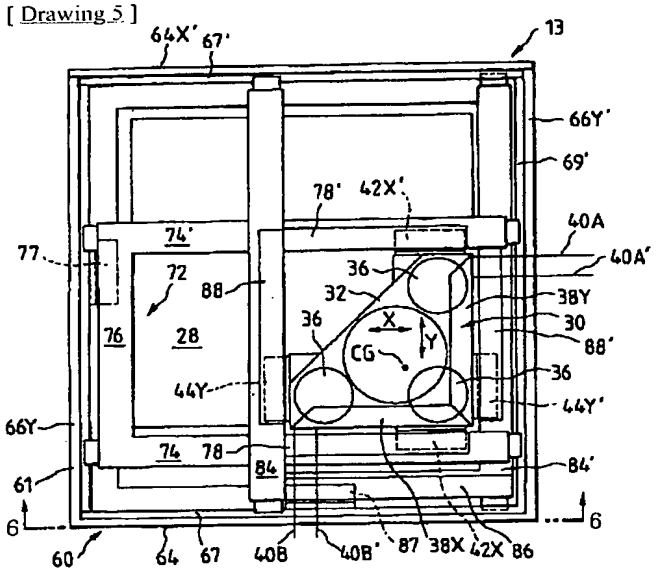

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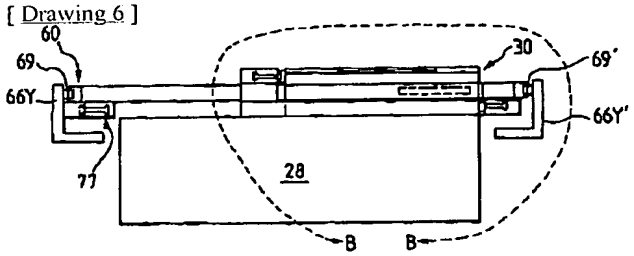
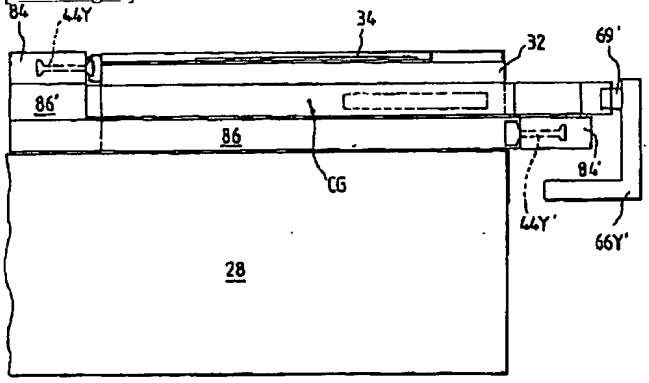
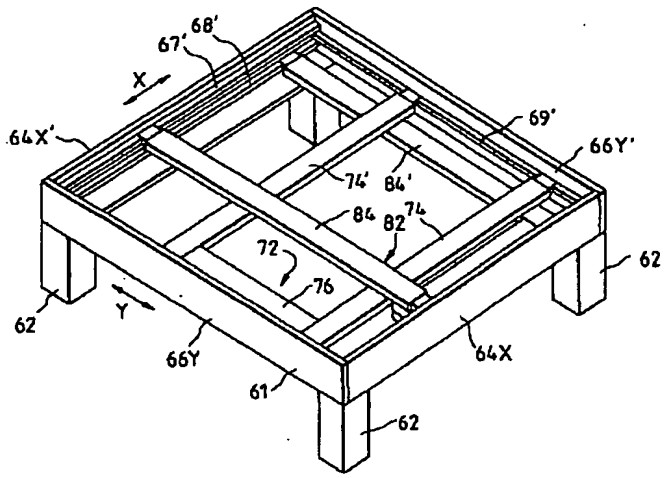


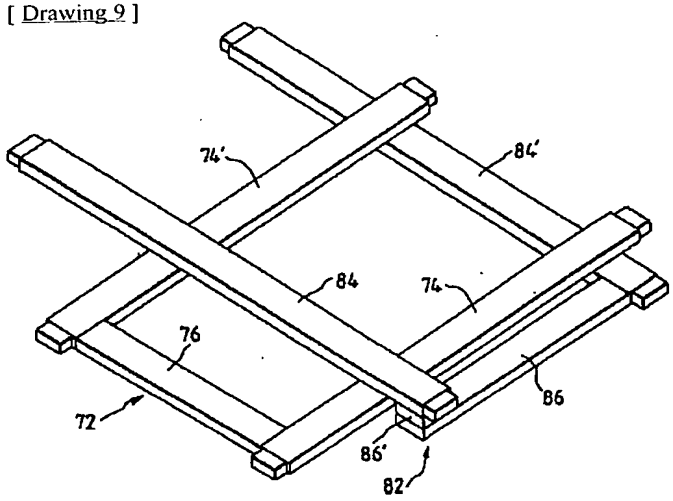
[Drawing 7]



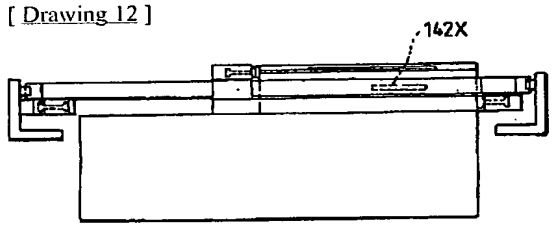
[Drawing 8]



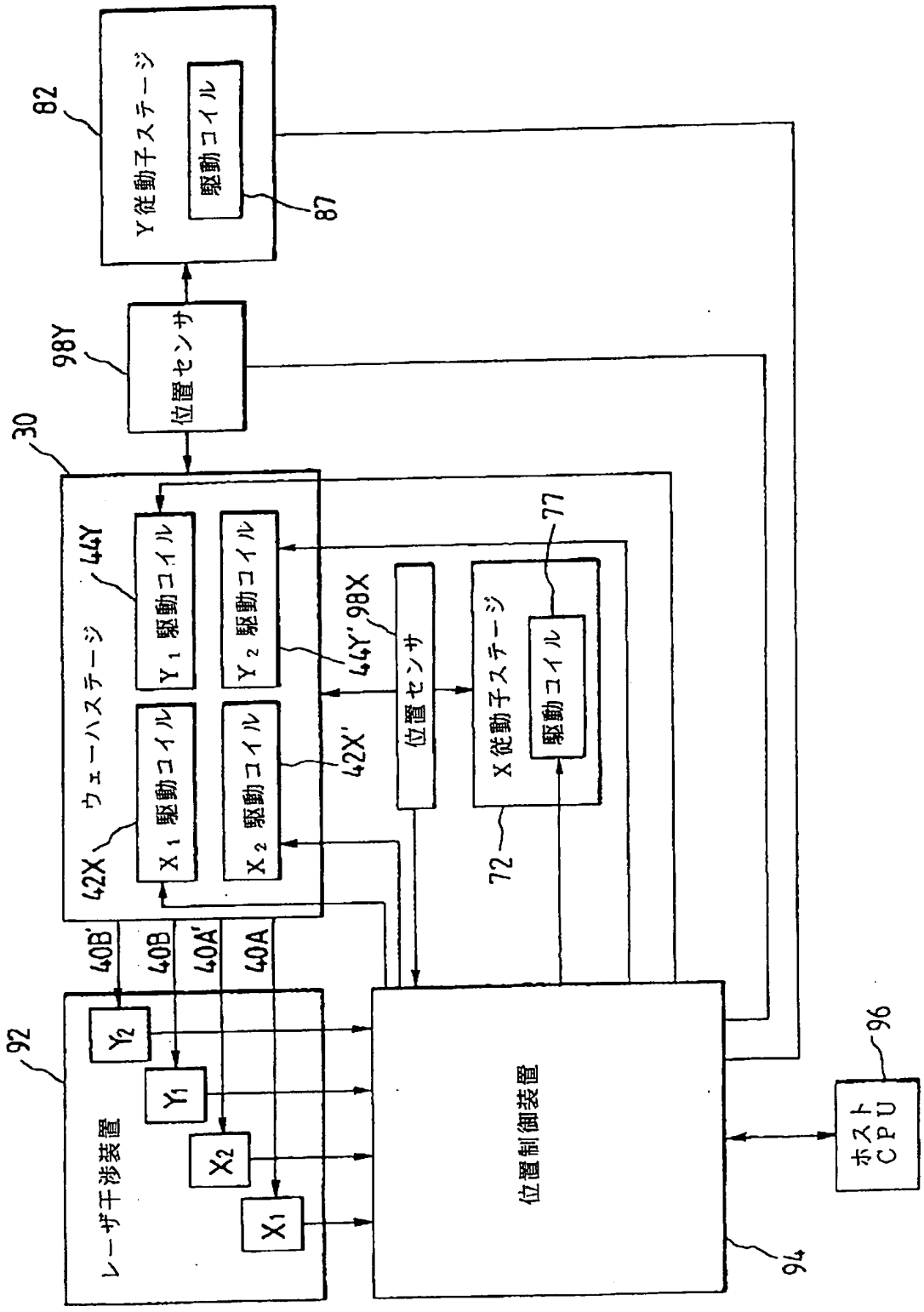
[Drawing 9]



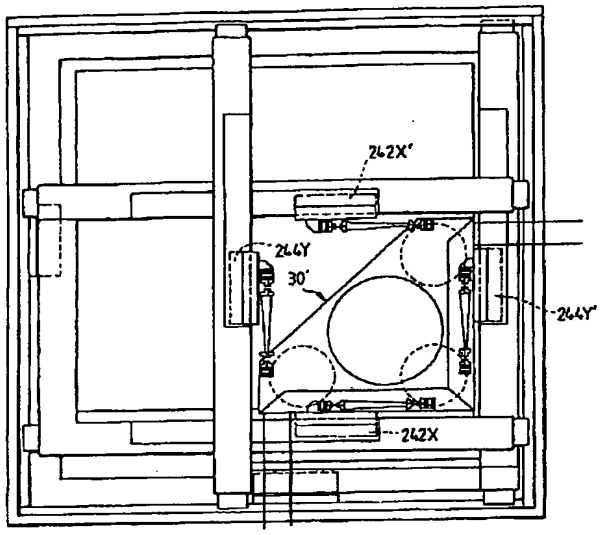
[Drawing 12]



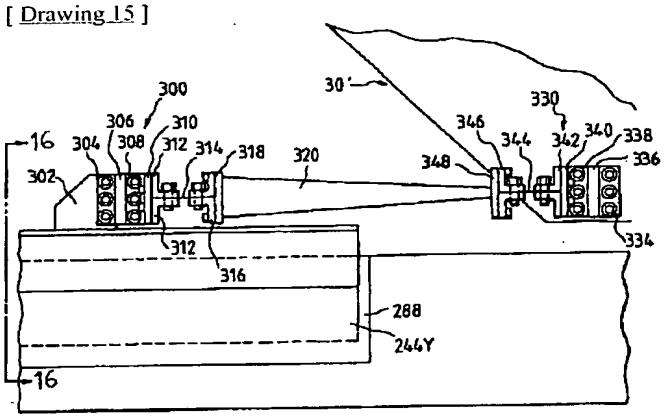
[Drawing 10]


82
Y従動子ステージ
駆動コイル
87
98Y
位置センサ
30
ウェーハステージ
44Y
Y1 駆動コイル
Y2 駆動コイル
42X
X1 駆動コイル
X2 駆動コイル
42X'
44Y'
98X
位置センサ
77
X従動子ステージ
駆動コイル
72
40B'
40B
40A'
40A
92
レーザ干渉装置
Y2
Y1
X2
X1
位置制御装置
94
96
ホスト
CPU

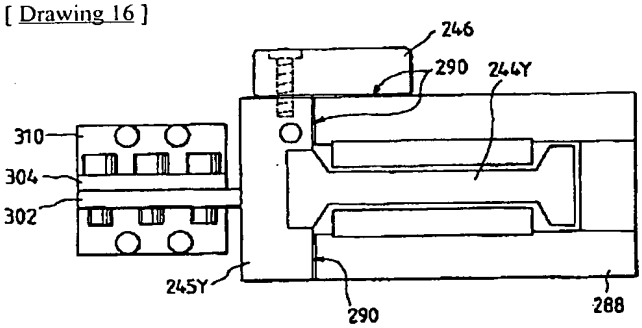
[Drawing 13]



[Drawing 15]



[Drawing 16]



[Translation done.]